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A procedure to simulate the likely evolution of induced seismicity and maximum magnitudes, during well stimulation

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We present a new procedure for simulating the most likely evolution of the volumes affected by induced seismicity during well stimulation, in terms of water injection or withdrawal. The method is based on a two-step procedure for simulation of the Coulomb stress changes in the rock volume surrounding the well as a response to fluid injection or withdrawal. The procedure consists of a fist phase of thermo fluid-dynamical simulation of the pressure and temperature changes caused by fluid injection/withdrawal, and of a second phase in which such changes are converted into Coulomb stress changes on favorably oriented faults. Assuming a certain threshold for the 'seismogenic' Coulomb stress changes we can also determine the evolution of perturbed volumes, from which, using suitable theoretical models, maximum magnitudes for the induced seismicity can be estimated. Such procedure can be iterated for each individual step in which the process of fluid injection/withdrawal can be subdivided, so allowing to simulate, in near real time during well stimulation, the possible evolution of induced seismicity and maximum magnitudes.